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EFFECT OF YIELD RESPONSE OF OKRA (ABELMOSCHUS ESCULENTUS L. MOENCH) UNDER DRIP IRRIGATION SYSTEM

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ABSTRACT

The experiment was conducted to study the yield response of okra (Abelmoschus Esculentus L. Moench) for different row spacing's and fertilizer application methods under drip irrigation during February-May 2015. Two row spacing's 40 × 40 cm and 50 × 40 cm were chosen. Fertilizer application in two methods viz. through fertigation tank and by manual application was considered. The analysis of data indicated that the yield response of okra was considered to be the better combination in 50 × 40 cm spacing with fertilizer application through fertigation tank when compared to other spacing and manual application of fertilizer. The pod parameters like pod perimeter, pod length, and pod width are also well influenced by the row spacing of 50 × 40 cm with the method of fertigation, as these values are observed to be best. The vegetative growth characteristics like plant height and number of branches are also reasonably good in 50 × 40 cm spacing and fertigation as compared to all other treatments.

KEYWORDS: Drip Irrigation, Fertigation, Wetting Pattern, Pant Parameters & Yield

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Original Article

INTRODUCTION

Land and water resources are the basic needs of agriculture and for the economic development of any country. The demand for these resources will continue to grow due to ever increasing population. The world population is increasing faster than the food supply. India has only 2.4% of land mass and4% fresh water resources of the world. Agriculture uses about 70 to 80% of total available water. Water is recognized as a vital resource both for livelihood, food security and environmental sustainability. If sufficient water resources are available, it is possible to increase the intensity of cultivation up to 300% or more and large extent of areas of waste/fallow lands can be brought under cultivation, which will solve the problem of food shortages for the increasing population. The ever increasing demand for irrigation water, everywhere, has now focused national attention and public interest on utilization of existing water supplies, integrated irrigation water conservation and management policy and practices. Micro irrigation system delivers water to the crop using network of various kinds of filtration systems, sub mains and laterals with emission points (drippers) spaced along the lateral length. Each emitter supplies a small, precisely controlled, uniform quantity of water, nutrients directly into the root zone of the plant. Water and nutrients enter the soil from emitters, moving into the root zone of the plant through the combined force of gravity and capillary. With this, the plant's intake of moisture and nutrient is replenished almost immediately, ensuring that plant never suffers from water stress, thus enhancing and improving quantity to achieve high yield.

These may be online drip, inline drip, micro-tube, pressure compensating, non-pressure compensating and self flushing types. For the irrigation of widely spaced crops like mango, coconut, banana, grapes and other high value vegetable crops, this system is most suitable. Drip irrigation works under low to medium pressures. i.e.

varies from 0.5 to 2 kg/cm^2. In line source tubing irrigation system, emitting devices are prefixed along the lateral lines. This system provides continuous flow of water to form the wetting strip on soil surface around the root zone of the crops. For row crops, closely spaced crops like vegetables, cotton, flowering crops, this system is suites ideally. At present most of the vegetable crops in India are grown using traditional methods of irrigation by planting the seeds at a fixed row to row and plant to plant spacing's as agronomical standards and fertilizer application by manually. As micro irrigation system is proved to be water saving system with higher productivity, it is considered to use drip irrigation system. With this concept in view, an experiment was planned to study the effect of drip irrigation system on the yield potential of okra (Bhendi) by planting with two different row to row spacing's and by two different methods of fertilizer application viz. through fertigation tank and manual application methods.

MATERIAL AND METHODS

Location of the Plot

An area of 480 sq m (32 × 15 m) near the threshing floor and beside the mango orchard at the back of workshop building in College of Agricultural Engineering, Bapatla was selected to grow the crop for experimental investigations and the field was cleared. The soil in the area is loamy sand in nature.

Fertigation Tank

An epoxy coated MS pressure tank was used as fertilizer tank. Specifications of the tank are as follows.

- Capacity - 30 ltr.
- Nominal pressure - 2 kg/m$^{2.}$
- Size of filter media - 3 to 5 mesh.

Scheme of the Experiments

Okra (Bhendi) was chosen as the test crop. The plot was kept ready by adding the required farm yard manure as per the recommended dose to sow the okra seed. In the second week of February, 2013 the plot was thoroughly wetted for 2 days. The plot having area of 480 sq m is divided into four sub plots as 8 × 15 m each to conduct experiments. The standard recommended spacing of plant to plant for okra crop is 30 cm to 45 cm. As the inline drip has perforations at 40 cm, the same spacing of 40 cm is maintained from plant to plant, as it also satisfies the recommended spacing of 30 to 45 cm. To study the effect of row to row spacing and also the effect of method of application of fertilizer, the plot is divided into four sub- plots with areas as indicated above to conduct the following scheme of experiments.

Sub plot I - To grow crop at 40 cm row to row spacing with recommended dose of fertigation.

Sub plot II - To grow crop at 40 cm row to row spacing with recommended dose of fertilizer application manually.

Sub plot III - To grow crop at 50 cm row to row spacing with recommended dose of fertigation.

Sub plot IV - To grow crop at 50 cm row to row spacing with recommended dose of fertilizer application manually.

The plant to plant spacing is not altered and maintained the spacing of 40 cm from plant to plant as per the

standard recommendation in all four sub plots.

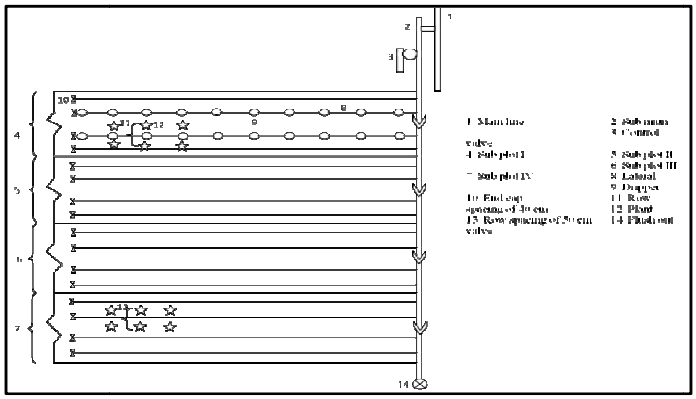

Figure 1: Layout of Field

The Following Equation of Modified Penman's Method is Used

$ET_P = C [WR_n + (1-W) f(u) (e_a-e_d)]$

Where ET_P = Potential Evapo-transpiration in mm/day

W= temperature related weighing factor

F (u) = Wind related function

$(e_a - e_d)$= difference between the saturation vapor pressure at mean air temperature and the mean actual vapor pressure of air, both in mbar

C= adjustment factor to compensate the effect of day and night weather conditions

Water Requirement of Plant in Lit/Plant/Day

= ET_P × Crop factor × Gross area per plant

By Taking Water Application Efficiency in Micro Irrigation As 90 % Amount of Water to Be Applied to A Plant in Lit. /Day

= Water requirement of a plant

Application efficiency

Time of Application

Drip system operating period = Amount of water to be applied to a plant

Discharge of dripper

Basing on the Modified Penman method, volume of water for okra crop was calculated and given in table.

RESULTS AND DISCUSSIONS

Yield Response of Okra with Spacing Of 40 × 40 Cm in Combination with Two Different Methods of Fertilizer Application

The total yield of okra in 19 pickings from 2nd April to 13th May with 2-3 days interval are presented in table 1.

The total yield obtained from sub plot I having 40 × 40 cm row spacing was 26.24 kgs with the method of fertigation and 37.41 kgs in sub plot II having the same spacing under manual application of fertilizer. The yield in the plot by manual application of fertilizer was observed to be higher by 42% in 40 cm row spacing, compared to the yield obtained in the same spacing with fertigation.

Table 1: Total Yield of Okra under Different Fertilizer Application Methods with 40 × 40 Spacing

Method of Fertilizer Application	Yield/Plot of 120 sq. m Area (kg)	Yield/Hectare (t/ha)	% Increase in Manual Application Compared to Fertigation
Through fertigation	26. 24	2.186	-
Manual application	37.41	3.117	42

Yield Response of Okra with Spacing of 50 × 40 Cm in Combination with Two different Methods of Fertilizer Application

The total yield of okra in 50 × 40 row spacing in 19 pickings is presented in table 2. The total yield obtained, from sub plot III was 38.16 kg and 31.29 kg in sub plot IV for the same spacing of 50 × 40 cm under fertigation and manual application of fertilizer respectively. The yield in the sub plot III with fertilizer application through fertigation tank is higher by 22%. The reason attributed for higher yield, may be due to well developed root system with vigorous growth of plant in wider spacing of 50 × 40 cm. The vigorous growth of plants might be due to the application of fertilizer through fertigation tank, which might have reached uniformly to the soil and every part of the plant.

Table 2: Total Yield of Okra under Different Fertilizer Application Methods with 50 × 40 Spacing

Type of Fertilizer Application	Yield/Plot of 120 sq. m Area (kg)	Yield/Hectare (t/ha)	% Increase in Fertigation Compared to Manual Application
Through fertigation tank	38.16	3.180	22
Manual application	31.29	2.607	-

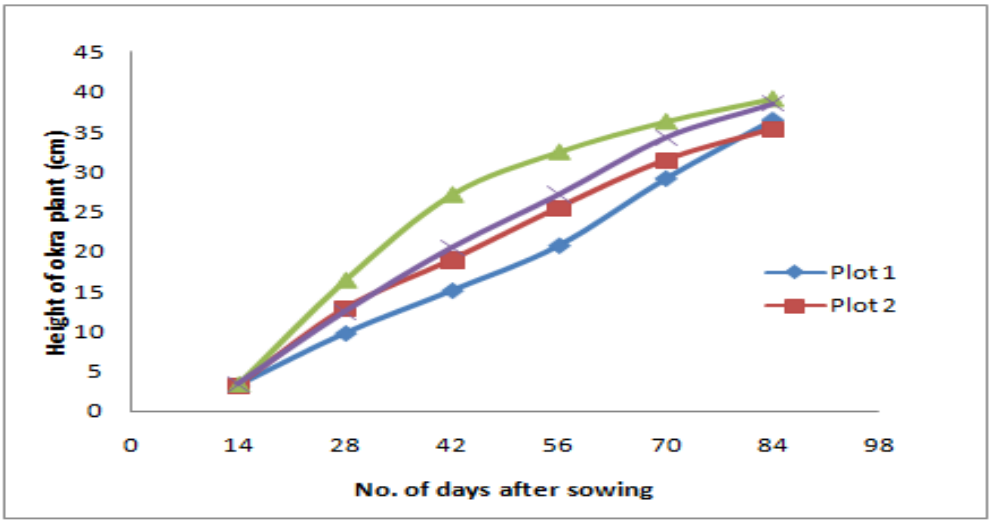

Figure 2: Trends to the Height of the Plant Treatment Wise

Table 3: Maximum Root Depth and Root Distribution of Okra Plant in Different Row to Row Spacing's and Fertilizer Application Methods

Sub Plot No	Row Spacing (cm)	Method of Fertilizer application	Mean of Maximum Root Depth(cm)	Mean of Maximum Lateral Length(cm)
I	40 × 40	Fertigation	14.66	12.62
II	40 × 40	Manual application	15.33	14.74
III	50 × 40	Fertigation	18.34	19.57
IV	50 ×40	Manual application	15.82	15.43

From the above table values, it can be concluded that the maximum root depth and lateral length of 18.34, 19.57 cm pertains to sub plot III with 50 × 40 cm row spacing and fertigation was observed to be higher than the other treatments. It also confirms to the higher yield as indicated earlier.

CONCLUSIONS

- 22% of higher yields were obtained in 50 × 40 cm spacing with fertilizer application through fertigation when compared to the same row to row spacing under manual application.
- 42% higher yields were obtained with 40 × 40 cm spacing under manual application of fertilizer when compared to the same spacing under fertigation treatment. The higher percent yield may be attributed to the direct placing of fertilizer manually in the vicinity of plant root zone and because of narrow spacing, the fertigation effect may not be very effective.
- Better quality characteristics like pod weight, pod length and pod perimeter were observed in 50 × 40 cm row spacing and fertilizer application through fertigation compared to other treatments.
- Maximum penetration of root depth and well developed distribution was observed in 50 × 40 cm row spacing and method of fertilizer application through fertigation tank compared to other treatments.
- The wetting pattern observed as 55 cm perimeter on surface and 70 cm depth of penetration. The same trend of wetting pattern was observed in all the treatments. From the observations, still there is a scope to increase the row spacing up to 60 cm.
- Overall, the yield response was observed to be best with 50 × 40 cm spacing with fertigation.

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